

# Making Cookie Shares

### Materials

- Pattern blocks
- Student Sheet 5 (2 per student)
- Transparency of Student Sheet 5
- Transparency pens in red, blue, and green
- Lists of fraction facts (from Investigation 1)
- Student Sheet 6 (1 per student)
- Overhead projector
- Colored pencils, markers, or crayons
- Stick-on notes

### What Happens

Students work in pairs to find and draw all the ways to make the equivalent of one yellow pattern block using blue diamonds (thirds), green triangles (sixths), and red trapezoids (halves). They write the fraction of the whole that each block represents. Students find the different shares of hexagon “cookies” they could give away and write some ways to make these shares. Their work focuses on:

- finding shapes to cover one whole
- identifying fractional parts that add to one whole
- writing fraction expressions



**Ten-Minute Math: Broken Calculator** Once or twice during the next few days, in a spare 10 minutes, play Broken Calculator. Pairs of students can share a calculator, but the activity is better if each student has one. Focus the activity on division problems that give targeted whole-number answers.

Choose a target number for students to get on their calculator display. Begin with a small number, perhaps 2 or 5 or 10. (Students will find interesting patterns when they try to get 10.)

**How can we use division to get an answer of 2 (or 5 or 10 or a larger number) on the calculator? Pretend that the plus, minus, and multiplication keys are broken.**

Give students time to find ways to get the number. They can talk together as they try. Write any ways that students find on the board so that other students can try them. Discuss what all the answers have in common. Give students a chance to find more solutions.

For full directions and variations on Broken Calculator, see p. 62.

## Cutting Up Cookies

On an overhead projector, display the transparency of Student Sheet 5, Hexagon Cookies. Have some pattern blocks available (yellow, red, blue, and green) to cover the hexagons on the transparency.

Let's say that this yellow pattern block is a cookie. How could we make a cookie like this with other pieces?

How many blue pieces do we need to cover a yellow cookie completely?  
How many red pieces? green pieces?

I'm going to give you a sheet filled with pictures of pattern-block cookies. Your task is to find lots of different combinations of red, blue, and green pieces that will cover a yellow hexagon cookie exactly.

Hand out Student Sheet 5, one to each student. They use pattern blocks to find solutions, then record their solutions on this sheet by drawing the smaller pieces onto the hexagons. For an orderly approach that will help them avoid repetition, they might start by finding all the ways of covering a yellow cookie with just one other color, and then two colors, and finally three colors. However they approach the problem, they should check their work to be sure they have no repeats.

Leaving the Hexagon Cookies transparency on the overhead or passing it around the room, ask students to draw the different ways they found to make the hexagon with the other pattern blocks. (You might want to begin with a few students who tend to be slow starters, then have some other students add one solution each.) If you have red, blue, and green transparency pens, let students use those to indicate the corresponding pattern blocks.

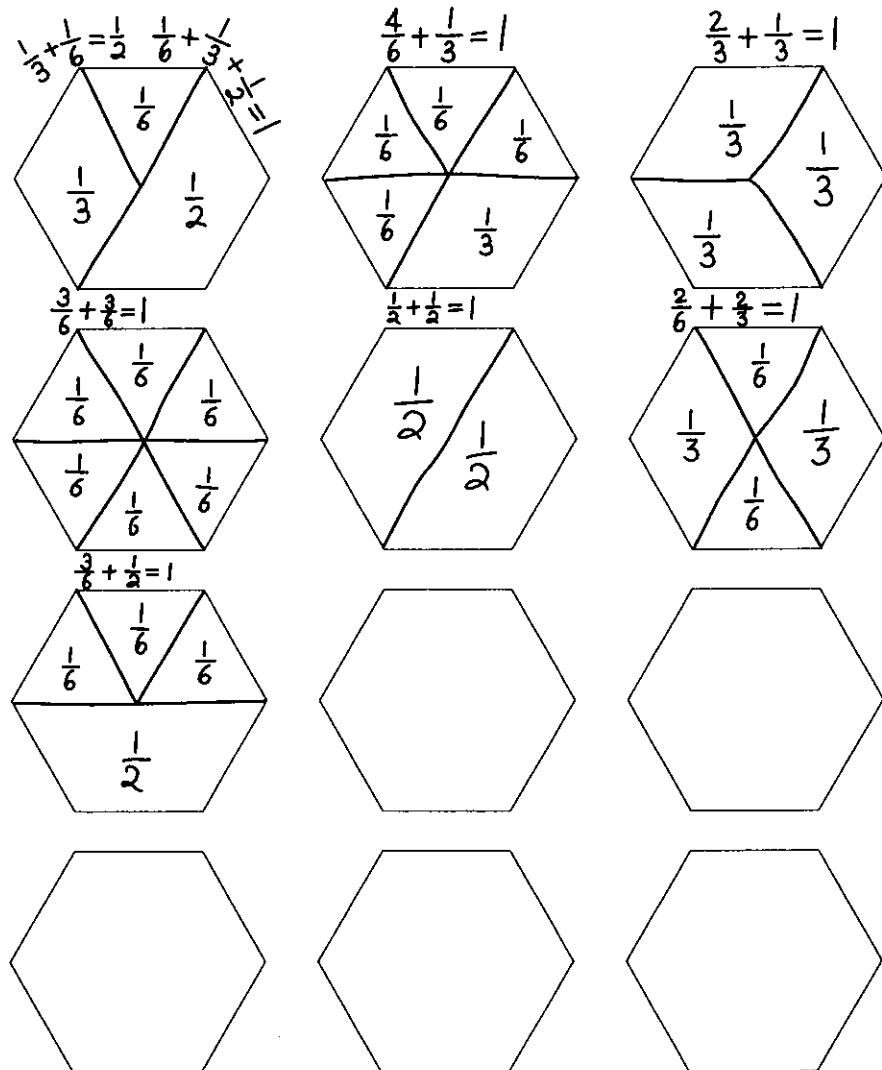
Display the completed transparency on the overhead. Students may copy any solutions that they don't have onto their own sheets, and check for repeats or missing solutions both on their papers and on the transparency. There are seven different ways to cover the yellow hexagon "cookie" with two or more pieces (see student's sample answers, p. 26).

**Naming the Fractional Parts** When students have drawn all the ways to divide the hexagon they can find, they write the corresponding fractions in each of the pieces. You might first have students identify a piece that is *half* the yellow cookie. When students agree on a piece that is half of the whole, write the fraction  $\frac{1}{2}$  in some of the red trapezoids on the transparency. Students then work on their own to decide what fractions the pieces of each hexagon represent, and write those fractions in all the corresponding spaces.

As you observe students, ask them how they are figuring out the fractional parts and encourage them to explain their methods to other students. If students are stuck, suggest that they make hexagons with only one color. Then ask:

**How many pieces did you use to make the whole? What fraction is each piece?**

As students finish, ask them to write number sentences next to the hexagons to show what fractions they used to make one whole, as the student has done below.



## Activity

### What Fractions Can You Give Away?

We found many ways of making a whole yellow cookie. What are some of the fraction sentences that you wrote next to your hexagons?

As students tell you different ways of making one whole, write the solutions as number sentences on the fraction facts list. Begin a section for facts about thirds, sixths, and halves if you haven't already.

Then ask students to consider how they might give away parts of pattern-block cookies.

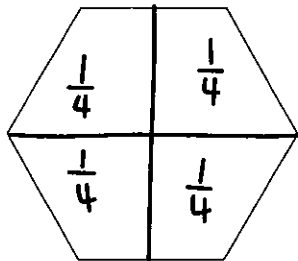
You could give away a whole cookie in several ways. Let's figure out what smaller fractions of this cookie we could give as one share.

Could we give away one-half a cookie? What are the ways you could make one-half of a cookie? How would you write those ways in number sentences?

Add a few of the students' suggestions to the list of fraction facts.

Could you give away one-fourth of a yellow cookie?

Students will discover that they can't give away one-fourth using this set of blocks. Some students may use two green blocks (two-sixths) and two blue blocks (two-thirds) as four unequal parts of a yellow cookie. Point out that because these shapes are unequal sizes, they are not fourths. Ask students what shape they would need in the pattern blocks to make fourths. (They would need a trapezoid that divides the hexagon into equal fourths; see if any students can draw this on the transparency.)



Could you give away one-third of a yellow cookie? (Yes, as one blue diamond or two green triangles.) What are all the parts of a yellow cookie that you could give away?

Students work with partners to list all the different-sized shares they could give away ( $1$ ,  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{6}$ ,  $\frac{2}{3}$ ,  $\frac{5}{6}$ ). This task should take only a few minutes. You might circulate and observe their lists while you hand out Student Sheet 6 for the next activity.

## Activity

### Making Shares in Many Ways

Introduce Student Sheet 6, Many Ways to Make a Share, at the board. Write one of the headings from the sheet, and ask students for their ideas.

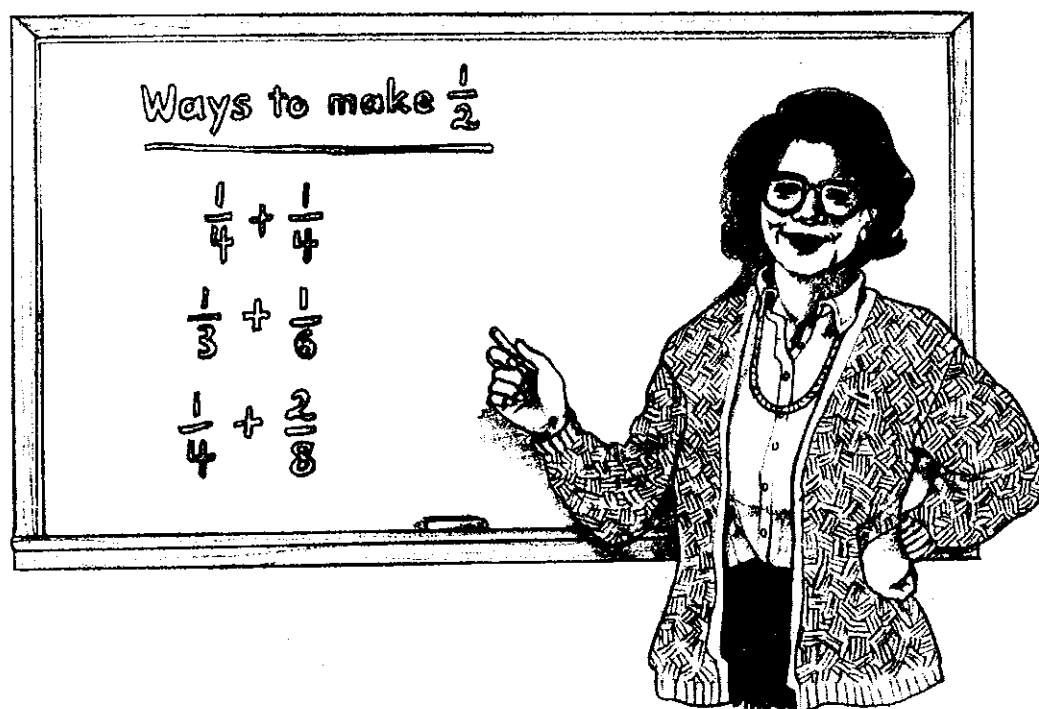
How can we make one-half from smaller pieces? Can you think of another way? Think about hexagon cookies. What pieces can you use to make half of a hexagon cookie? Then think about our paper brownies. How can you make half a brownie? How would we write that in fractions?

As students make suggestions, write their ideas on the board in fraction notation.

How can we make one-third from smaller pieces? How can we make two-thirds?

Once students have the idea, they can start working independently or with partners on Student Sheet 6, writing expressions under each of the different headings. Although they start the sheet in class, they will continue to add more expressions as homework.

To make some of the fractions larger than  $\frac{1}{2}$ , challenge students to combine fourths and sixths or eighths and sixths (for example, one way to make  $\frac{3}{4}$  would be  $\frac{3}{6} + \frac{1}{4}$ ).



## Activity

### More Fraction Facts

During this class or at a later time, work with small groups or the whole class to expand the lists of fraction facts that you started in Investigation 1. Most of the facts from sharing brownies in the first investigation involved halves, fourths, and eighths; most of the facts from the pattern-block cookies involve thirds and sixths. Also ask students if they have found any surprising combinations at home working with Fraction Cards. You might start a new list of facts that combine fractions from the first two lists.

After listing facts students have observed in recent work, challenge students to make number sentences that join fraction combinations representing equal amounts. For example:

$$1 = 2 \text{ halves} \quad \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 1, \text{ so } \frac{1}{2} + \frac{1}{2} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$

$$\frac{2}{3} = \frac{1}{3} + \frac{1}{3} \quad \frac{2}{3} = \frac{1}{6} + \frac{1}{6} + \frac{1}{3}, \text{ so } \frac{1}{3} + \frac{1}{3} = \frac{1}{6} + \frac{1}{6} + \frac{1}{3}$$

Students can add more facts to the list as they discover them. Make stick-on notes available for students to initial and place next to facts they don't understand or that they think are incorrect. When some facts are in question, take time out for the students to discuss them.

## Sessions 1 and 2 Follow-Up

**Many Ways to Make a Share** Students continue to add solutions to Student Sheet 6, Many Ways to Make a Share. Encourage students to get ideas from family members, but to be sure to write only those ideas that make sense to them. You may want to suggest that students trace the blue diamond, green triangle, and red trapezoid to use as references at home.



### Homework